FURTHER NOTES ON AUSTRALIAN ICHTHYOSAURS.

By H. A. Longman (Director)

Plate X.

In 1922 an almost complete skull of a large Ichthyosaur from Hughenden, western Queensland, was described in detail and illustrated, with references to literature[1]. This fossil was recorded as *Ichthyosaurus australis* McCoy.

A concise description was given in 1935 of the most complete skeleton yet found in Australia, this having been collected in the same year by Mr. J. Edgar Young from Cretaceous deposits on Telemon Station, near Hughenden, western Queensland[2]. As the result of careful and persistent work by Mr. Young, this fossil has been largely cleared of matrix and it was recently placed on exhibition in the Queensland Museum, where it forms a notable addition to our palaeontological court.

The preserved portion of the skeleton is about 18 feet in length, but the posterior limbs and a section of vertebrae are missing. Over ninety vertebrae are present. The paddles are of the Latipinnate type and a pisiform articulates with the humerus, as previously recorded.

In the skull described in 1922 comment was made on the rectangular process raised above the plane of the frontal region, which suggested "apparently unique characteristics" for an Ichthyosaurian, probably requiring new generic distinction. Unfortunately this region is so much disrupted in the second skull that no evidence is available to afford satisfactory basis for a generic diagnosis. In the circumstances it is still recorded as *Ichthyosaurus australis*.

During the very laborious work of freeing the second skull (F.2453) from matrix, Mr. Young was able to expose a complete series of fifteen sclerotic plates in the left orbit, these having been buried under several inches of closely-investing calcareous mudstone.

The approximate diameter of these plates is 150 mm., whilst the diameter of the opening is 55 mm. Owing to vertical pressure the contours of the orbit are obviously flattened, but the sclerotic plates evidently occupied a very large portion of the cavity. They have been irregularly pressed inwards and two have been fractured, but the series is fairly well preserved. The apparent evidence of overlapping in this specimen is probably due to oblique post mortem pressure, which disrupted the interlocking ridges. This section is the subject of Plate X. The complete skull is approximately 52 inches (1320 mm.) in maximum length.

Fortunately another cranial fragment (F.2451), collected by Mr. Young from the same locality, showed evidence of sclerotic plates in a disrupted right orbit and these were very carefully freed from the surrounding matrix. Four contiguous plates are fairly well preserved and present no evidence of normal overlapping.

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[1] H. A. Longman, Mem. Qld. Mus., VII, pt. 4, 1922, pp. 246-256, Plates XV-XVI.

[2] H. A. Longman, Mem. Qld. Mus., X, pt. 5, 1935, p. 236.

Between two of the plates in this fragment an exposed section shows definite evidence of interlocking ridges which, in normal juxtaposition, would prevent any overlapping. The contact of the lateral edges is somewhat similar to that illustrated by C. W. Andrews (Plate 1, fig. 10) for *Ophthalmosaurus*[3].

This cranial fragment enabled a cross-section of the plates to be entirely exposed and a reconstruction, shown in Text-figure 1, was then possible. This has been used as an illustration with labels with the fossils on exhibition. A well-marked feature of the exposed plates is the thickening at the periphery, where the actual edge is convex and not rectangular. This attains a thickness of 7 mm.

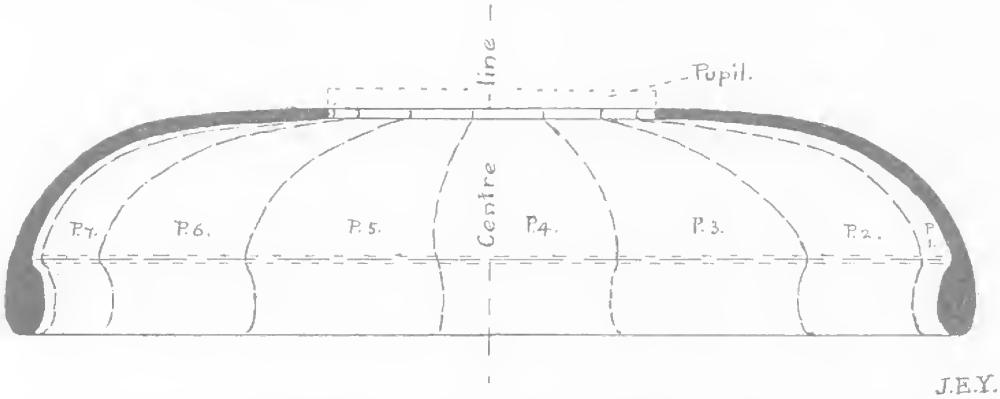

Diagram showing cross-section of Sclerotic Plates in eye of this Ichthyosaurus.

As there are very few records of the actual structure of the armoured eyes of these marine reptiles, it is hoped that the result of Mr. Young's patient work will be of some interest.

The region of the eye in McCoy's original specimen was so poorly preserved that he was only able to give a somewhat indefinite account of the sclerotic plates. He was not able to count the number of pieces precisely, but thought there were about thirteen[4].

In looking through some of the available literature regarding these well-known sclerotic plates in Ichthyosaurs, it is interesting to find diversity of opinions.

We can go back to 1814 and read Everard Home's first account of the fossil animal from Dorsetshire with the " bony sclerotic coat of the eye," to which he gave the name *Proteo-saurus* in 1819[5].

W. D. Conybeare's description of *Ichthyosaurus* in 1821[6] (using Koenig's name of 1818) also refers to the well known " sclerotica." The " bony plates of the eye " are a striking feature in the illustrations with these early accounts.

Writing of these bony plates in a Bridgewater Treatise, Dr. Buckland eloquently records " that the enormous eye of which they formed the front was an

[3] C. W. Andrews, Marine Reptiles of the Oxford Clay, Part I, 1910. Brit. Mus.

[4] F. McCoy, Trans. & Proc. Roy. Soc. Vict. IX, 1869, p. 77.

[5] Everard Home, Phil. Trans. 1814, pp. 571-576, Plate XVII, and Phil. Trans, 1819, p. 209-216, Plate XIII.

[6] W. D. Conybeare, Phil. Trans. 1821, pp. 559-590, Plate 40.

optical instrument of varied and prodigious power, enabling the *Ichthyosaurus* to descry its prey at great or little distances, in the obscurity of night, and in the depths of the sea," a statement which Richard Owen quoted in his Palaeontology.

C. W. Andrews in his great work on Marine Reptiles of the Oxford Clay (*loc. cit.* p. 31) illustrates the plates in the eye of *Ophthalmosaurus*, the edges of which interlock " in such a way that no movement can have taken place between them." He notes that the Ichthyosaurian eye " does not seem to have been satisfactorily described."

Gilmore in his elaborate study of *Baptanodon* records the overlapping of the plates, the edges of which have a long free union, allowing the sclerotic ring to expand and contract considerably[7].

Loris S. Russell in his study of " The Sclerotic Ring in the Hadrosauridae " has given an interesting account of the overlapping of these ossifications or chondrifications in a variety of vertebrates, with special reference to the Hadrosauridae[8].

Barnum Brown notes that in *Saurolophus osborni*, a crested Dinosaur from the Edmonton Cretaceous, the sclerotic plates so overlapped that " it was possible to dilate the pupil to twice its normal size." He compares this small eye in a relatively large orbital opening with the different mechanical adjustment in *Ichthyosaurus* " where the sclerotic ring fills the orbital opening. In *Ichthyosaurus* the plates are attached at their base on the outside of the ring which remains the same diameter while the plates passed over each other in dilation or contraction similar to the movement of an iris diaphragm camera shutter.[9]"

It is evident that the eyes of Ichthyosaurs present varying degrees of specialisation, perhaps the extreme being reached in the *Baptanodon* type, which were apparently the largest known among vertebrates. Doubtless some of these specialisations may be obscured by fossilisation, subsequent to post mortem contraction.

It is probable that the Ichthyosaurs, although mainly pelagic, were good divers as well as strong swimmers, and these massive plates were mainly resistant walls to varying water pressure. Even whales with their relatively small eyes may be equipped with cartilaginous protection. But we may also look for specialisations associated with the contrast of strong sunlight at the surface and the murkiness of considerable depths.

The reduction of the convexity of the actual eye-ball with a corresponding contraction of divergent plates towards the centre may be an alternative to the overlapping that has been aptly compared with the mechanism of an iris diaphragm. Muscles corresponding to the sphincter and dilator pupillae in the true iris of a modern eye, however, can scarcely be conceived as manipulating these massive plates in Ichthyosaurs, even if we suppose an extension of their functions.

The sclerotic ossifications in some species of Ichthyosaurs may have been as immobile as the rigid unsegmented ring found in certain adult birds.

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[7] C. W. Gilmore, Men . Carn. Mus. II, No. 9, 1906, p. 328.

[8] Loris S. Russell, Contrib. Roy. Ontario Mus. of Pal., No. 3, 1940.

[9] Barnum Brown, Bull. Amer. Mus. Nat. Hist., Vol. XXI, 1912, p. 136.

Among the avian eyes examined, that of the well-known nocturnal *Podargus strigoides* exhibits a homogeneous ring from which all segmentation has disappeared. The adult eye of our large sea eagle *Haliaetus leucogaster* also has a rigid unsegmented mantle of bone. These two species, one nocturnal and the other a lover of sunlight, have eyes of extraordinary efficiency.

Obviously there are many avian types with segmented rings that are largely ankylosed. At the other extreme, an imbricating series of mobile plates as recorded for some other vertebrates suggests a different function and a distinctive musculature.

Vertebrae.—In our collections there are two conjoined typical biconcave vertebrae of the Ichthyosaurian type, from an unknown locality but presumably from western Queensland, which are considerably larger than those in the skeleton now on exhibition. These were presented by the late Mr. J. Cowan, of Brisbane (Reg. No. F.1500). They have a maximum diameter of 125 mm. and a length of 56 mm. The paired tubercles are centrally situated and the vertebrae are probably median dorsals. As these are about an inch greater in diameter than those recorded by McCoy for his type specimen, which he calculated to be twenty-five feet in length, it is suggested that this species may attain at least thirty feet. These predacious reptiles, however, were dwarfed by the mighty *Kronosaurus*, which still remains the most remarkable fossil yet found from our Cretaceous deposits.